SECTION I.—AEROLOGY.

SOLAR AND SKY RADIATION MEASUREMENTS DURING AUGUST, 1918.

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[Dated: Weather Bureau, Washington, D. C., Oct. 2, 1918.]

For a description of instrumental exposures, and an account of the methods of obtaining and reducing the measurements, the reader is referred to the Review for January, 1918, 46:2.

The monthly means and departures from normal values given in Table 1 show that direct solar radiation averaged above normal at Washington, D. C., and Lincoln, Nebr., very close to normal at Santa Fe, N. Mex., and slightly below normal at Madison, Wis.

Morning measurements made at Madison after the 26th have not been included, as a defect in the pyrheliometer leads was discovered later that cast doubt upon the accuracy of the morning readings after that date. For the reason given in connection with the July report, less than the usual number of readings were obtained at Lincoln during the current month.

Table 3 shows only unimportant departures from the normal for the month at Madison, and deficiencies of about 3 per cent at Washington and Lincoln.

Skylight polarization measurements at Washington on four days give a mean of 57 per cent with a maximum of 62 per cent on the 23d. Measurements at Madison on eight days give a mean of 62 per cent with a maximum of 71 per cent on the 31st. These readings are slightly above the average for the respective stations.

TABLE 1.—Solar radiation intensities during August, 1918.

[Gram-calories per minute per square centimeter of normal surface.]

Washington, D. C.

	Sun's zenith distance.													
Date.	0.0°	48. 3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78. 7°	79.8°				
2001	Air mass.													
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5				
A. M.	cal. 1. 21	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.				
Aug. 12	1. 21	1.00	0.80	0.70	0.61	0.54	0.50	0.45						
15	1. 25	1.11	1.00	0.90										
16		1. 13	1.00	0.89	0.80									
21	1.46	1.35	1. 25	1. 16	1.08									
23	1.05		0.74	0.67	0.61									
Monthly means	1.24	1.15	8.96	0.86	0. 78	(0.54)	(0, 50)	(0. 45)						
Departure	1.24	1. 13	0.70	U. 00	U. 70	(0.34)	(0. 30)	(0.43)						
from 10-year						1	1							
normal	±0.00	+0.08	+0.06	+0.04	+0.04	—0. 10	-0. 64	-0.08	 -					
Р. М.		l			1]				
Aug. 15		1.19	1.10	1.02	0.94	0.87	0.80	0.74	0.68					
21			1. 23	1. 12	1.03									
Monthly														
means		(1. 19)	(1. 16)	(1.07)	(0.98)	(0.87)	(0.80)	(0. 74)	(0. 68)					
Departures	ļ								ĺ	l .				
from 10-year normal	1	+0.10		10.22		1 8 21				1				
normal		-+ v. 10	↑U. 19	+0.22	+0.21	+0.21	+0.21	+0.21	+0.14					

TABLE 1.—Solar radiation intensities during August, 1918—Contd.

			ľ	Madiso	n, Wis	•								
				Sun	's zenitl	ı distan	ce.							
Date.	0.0°	48.3°	60. 0°	66. 5°	70. 7°	73.6°	75. 7°	77.4°	78. 7°	79.8°				
	Air mass.													
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5				
A. M. Aug. 6	cal. 1, 12 1, 16	cal. 1. 05 1. 05	cal. 0. 92 0. 94	cal. 0.85 0.85	cal. 0.77 0.77	cal. 0.70 0.68	cal. 0. 63 0. 62	cal. 0.57 0.56	cal.	cal.				
19 24 25 26	1. 39 1. 39 1. 45	1. 27 1. 29			0. 95	0.89	0. 82 0. 83	0. 77						
Monthly means Departure	1.30	1. 16	(0. 93)	(9. 85)	0. 83	0. 76	0. 73	0. 63						
from 8-year normal P. M.	-0.01	-0.02	—0. 15	0. 15	-0.0 8	0. 12	-0.08	—0. 15	•••••					
Aug. 22 26 Monthly means		1. 05 1. 30 (1. 18)	1. 16 (1. 16)	1.08	1.01 (1.01)	0, 94 (0, 94)	0.87 (0.87)	0.82 (0.82)	0.77 (0.7 7)	0.78 (0.73)				
Departure from 8-year normal		+0.03	+0.14	+0.13	+0.16	+0.14	+0.07	+0.06	+0.16	+0.03				
]	I	incolr	ı, Nebr	•				<u> </u>				
А. М.					1		1			<u> </u>				
Aug. 13 26	1. 47	1. 20	1.09						 					
29 31	1.40	1. 15 1. 28	1.04 1.17	1.08	1.00	0. 93	0.86	0, 79						
Monthly means Departure	(1.44)	1.21	1. 10	(1.08)	(1.00)	(0. 93)	(0. 86)	(0. 79)						
from 4-year normal P. M.	+0. 10	+0.02	+0.02	+0.09	+0. 10	+0.07	+0.05	+0.05						
Aug. 12 26 29 31		1.37 1.00	1. 27 0. 89 1. 19	1. 17 1. 10	1.08 0.68 1.00	1. 02 0. 59	0. 96 0. 51	0.67 0.90 0.44	0. 61 0. 85 0. 40	0.56 0.80 0.37				
Monthly means Departure		(1. 18)	1, 12	(1. 14)	0. 92	(0. 80)	(0. 74)	0. 67	0. 62	0. 58				
from 4-year normal		-0.02	+0.02	+0. 12	±0, 60	-0. 05	-0. 03	-0. 07	-0. 10	-0. 11				
			Sa	nta Fe	, N. M	ex.	·		r					
Aug. 1 2	1.39 1.38	1. 29 1. 26	1. 21 1. 16	1. 13 1. 03 1. 07	1.05 0.94 0.99	0.98	0. 92 0. 88	0.87	0.84					
5 9			1. 19	1.13	1.02	0.94	0.86							
10 13		1. 28	1. 23					0.82						
15 17	1. 39	1. 34	1. 19			0. 99	0. 92	0.87	0. 81					
23 26		1. 38 1. 35 1. 27	1. 25 1. 26	1. 19	1. 10	1. 02	0.94							
27	1 40	1. 27	1.27	1. 17	i. ii	1.05	0. 97 1. 00	0. 95	0.90					
29 30			1.09	1.02	0. 92	0.84								
Monthly means Departures from 6-year	1.40	1.31	1. 21	1, 10	1. 02	0. 97	0. 93	0.88	0, 85					
normal P. M. Aug. 19		-0.01 1.40	-0.01	-0.04	-0. 95	-0.04 1.09	-0. 02	-0.04	_0. 0 7					
23 Monthly means		1.45	1. 32	1. 24	1. 16 (1. 16)	1.10	1.04	1	ł					

TABLE 2.-Vapor pressures at pyrheliometric stations on days when solar radiation intensities were measured.

Washir	Washington, D, C.			Madison, Wis.			Lincoln, Nebr.			Santa Fe, N. Mex		
Dates.	s. m.	p. m.	Dates.	a. m.	p. m.	Dates.	a. m.	p. m .	Dates.	a. m.	p. m.	
1918. Aug. 12 14 15 16 21 23	mm. 19. 89 19. 23 12. 68 13. 13 11. 38 14. 60	19. 89 12. 68 15. 11 13. 61	13 19 22 24	mm, 14, 10 16, 20 11, 38 17, 96 15, 11 13, 13 13, 13	16. 79 10. 59 19. 23 12. 24 13. 13	13 26 29	mm. 13. 13 17. 37 11. 38 8. 48 7. 04	15. 11 7. 29 14. 10	1918. Aug. 1 2 3 5 9 10 13 15 17 19 23 28 27 29 30	mm. 7. 87 7. 87 7. 29 6. 27 10. 59 7. 87 8. 88 7. 87 9. 83 5. 79 9. 14 7. 29 7. 29 7. 87	7. 29 7. 87 10. 59 10. 59 7. 87 7. 29 6. 76	

TABLE 3.—Daily totals and departures of solar and sky radiation during August, 1918.

[Gram-calories per square centimeter of horizontal surface.]

	Da	ily tota	ls.	Dep	artures : normal.	from	Excess since f	Excess or deficiency since first of month.			
Day of month.	Wash- ing- ton.	Madi- son.	Lin- coin.	Wash- ing- ton,	Madi- son.	Lin- coln,	Wash- ing- ton.	Madi- son.	Lin- coln.		
Aug. 1	cal. 480 467 477 314 542 533 476 536 463 296	cal. 425 545 573 286 495 588 489 375 538 475	cal. 651 627 627 663 614 571 215 294 306 574	cal. - 3 - 15 - 4 - 166 63 56 2 65 - 5 - 169	cal 50 72 102 -183 28 124 27 - 84 81 21	cal. 115 94 96 135 88 48 -304 -222 -206 65	cal 3 - 18 - 22 - 188 - 125 - 69 - 67 - 2 - 7 - 176	cal 50 22 124 - 59 - 31 93 120 36 117 138	cal. 115 209 305 440 528 576 272 50 —156 — 91		
11	383 503 440 503 609 575 126 84 525 543	258 552 509 573 411 77 121 499 593 429	415 613 421 287 447 521 315 520 525 360	- 79 44 - 16 50 159 128 -318 -356 88 109	193 104 64 130 29 361 314 67 163	- 90 111 - 67 -208 - 44 33 -169 39 57 -115	- 255 - 211 - 227 - 177 - 18 110 - 208 - 564 - 476 - 367	- 55 49 113 243 214 -147 -461 -394 -231 -229	-181 - 70 -137 -345 -389 -356 -525 -486 -429 -544		
Decade depe	rture		1 :••••	;;	·	! ;	_ 191	-367	-453		
21	593 437 500 574 500 400 412 89 372 422 338	365 532 243 558 504 565 478 283 527 297 548	590 405 389 564 474 599 521 358 542 142 614	162 9 75 152 80 - 18 - 4 -325 - 40 12 - 70	- 60 110 -177 141 90 154 70 -122 125 -102 152	118 - 64 - 77 101 14 131 66 - 95 92 -306 168	- 205 - 196 - 121 31 111 93 89 - 236 - 276 - 264 - 334	-289 -179 -356 -215 -125 29 99 - 23 102 0 152	-426 -490 -567 -466 -452 -321 -255 -350 -258 -564 -396		
Decade depe	arture	I	l 	il 	J	! •••••	+ 33	+381	+148		
Excess or deficien	cy since	first of	$\mathbf{year}_{\mathbf{P}_0}^{G_1}$	rcal er cent			-1,266 - 1.3	+938 +1.0	+276 +0.2		

VOLCANIC ERUPTIONS AND SOLAR RADIATION INTENSITIES.

By HERBERT H. KIMBALL, Professor of Meteorology. [Dated: Washington, D. C., Sept. 13, 1918.]

In previous papers 1 curves have been presented showing variations in the annual mean values of solar radiation intensity at a few stations, for the period 1883-1912. These have been quoted by different writers,2

and it now seems advisable to bring them up to date, since the last curve published ends in the midst of the depression of 1912-13, following the eruption of Katmai Volcano, Alaska, in June, 1912.

In Table 1 there is given for each station the month and year of the beginning and ending, and reference to a footnote gives the character, of the data utilized in constructing this new curve. The data for some of the stations is not complete. For example, at Simla, India, radiation measurements are rarely obtained in July or August. At Mount Weather, Va., the records were frag-mentary until May, 1911, and the same is true of the early part of the records at Madison, Wis., and Santa Fe, N. Mex. The records of these two latter stations were not employed previous to 1914, except in determining the monthly normals for these stations.

TABLE 1.—Duration and character of solar radiation intensity records.

Year.	Montpellier, France.	Lausanne, Switzer- land.	Paviovsk, Russia.	Warsaw, Poland.	Washington, D. C.	Simla, India.	Paris, France.	Mount Weather, Va.	Madison, Wis.	Santa Fe, N. Mex.	Lincoln, Nebr.	Total number of stations.
1882 1883 1884 1885 1886 1886 1890 1890 1891 1892 1893 1894 1895 1896 1990 1900 1901 1902 1903 1904 1905 1906 1907 1909 1910 1910 1911 1912 1913 1914 1916 1918	Dec.	Jan. X X X X X X Aug.	Sept + + + + + + + + + + + + + + + + + + +	Jan. + + + + + + + + + + + + + + + + + + +	June OCCOO Aug.	Oct. XXXXXXXDec.	Jan. + + + + + Dec.	Sept.	<u>පූ</u> රගගටලිලි	(jet)	jaoo ja	111112112211233333333334666655545444

X—monthly means of noon solar radiation intensities.

+—monthly maxima of solar radiation intensities.

—monthly means of solar radiation intensities with the sun at zenith distance 60°.

(O)—data inclosed in curves employed only in completing the monthly normals of the respective stations.

For stations in the United States the monthly normal has been obtained by dividing the sum of all the radiation intensities measured in the months of a given name by the total number of measurements. For the other stations it has been necessary to take the average of the monthly means for the monthly normal.

The monthly means or the monthly maxima for each station have next been expressed as a percentage of either the monthly normal or the average monthly values, and the mean of the percentages for all the stations determined for each month. These monthly means have been

smoothed by the formula $\frac{a+2b+c}{a}$, where b is the mean

for the month in question, and a and c are the means for the preceding and following months, respectively.

¹ Kimball, Herbert H. Bulletin of the Mount Weather Observatory, 3:111; 5:301.
2 Humphreys, W. J. Volcanic dust and other factors in the production of climatic changes, and their possible relation to the ice ages. Bulletin of the Mount Weather Observatory, 6:1-34.

4 bbot, C. G., & Fowle, F. E. Volcanoes and climate. Annals of the Astrophysical Observatory of the Smithsonian Institution, 3:211-229.